TÜVRheinland®

Produkte
Products

Prüfbericht - Nr.: *Test Report No.:*	**50034429 001**	**Seite 1 von 30** *Page 1 of 30*

Auftraggeber: *Client:*	**New Japan Radio Co., Ltd.** 1-1, Fukuoka 2-Chome, Fujimino City Saitama, 356-8510 Japan
Gegenstand der Prüfung: *Test Item:*	**K-Band Doppler Sensor Module (Movement Sensor)**
Bezeichnung: *Identification:*	**NJR4265RF3**
Serien-Nr.: *Serial No.:*	**Sample No.1**
Wareneingangs-Nr.: *Receipt No.:*	**A000271213**
Eingangsdatum: *Date of Receipt:*	**2015-10-23**
Zustand des Prüfgegenstandes bei Anlieferung: *Condition of Test Item at Delivery:*	**Good**
Prüfort: *Testing Location:*	**TÜV Rheinland Japan Ltd. – Global Technology Assessment Center** 4-25-2 Kita-Yamata, Tsuzuki-ku, Yokohama 224-0021, Japan
Prüfgrundlage: *Test Specification:*	**FCC 47 CFR Part 15, Subpart C, Section 15.245 (October 1, 2014)** **RSS-210 (Issue 8): 2010** **RSS-Gen (Issue 4): 2014** ANSI C63.10-2013
Prüfergebnis: *Test Result:*	**Der Prüfgegenstand entspricht oben genannter Prüfgrundlage(n).** *The test item passed the test specification(s).*
Prüflaboratorium: *Testing Laboratory:*	**TÜV Rheinland Japan Ltd. – Global Technology Assessment Center** 4-25-2 Kita-Yamata, Tsuzuki-ku, Yokohama 224-0021, Japan

geprüft/ *tested by:*			**kontrolliert/** *reviewed by:*		
2016-01-15	A. Abe / Inspector		2016-01-15	R. Meiranke / Reviewer	
Datum *Date*	**Name/Stellung** *Name/Position*	**Unterschrift** *Signature*	**Datum** *Date*	**Name/Stellung** *Name/Position*	**Unterschrift** *Signature*

Sonstiges / *Other Aspects:*

IC certification has been postponed by the customer.

Abkürzungen:				*Abbreviations:*			
P(ass)	=	*entspricht Prüfgrundlage*		*P(ass)*	=	*passed*	
F(ail)	=	*entspricht nicht Prüfgrundlage*		*F(ail)*	=	*failed*	
N/A	=	*nicht anwendbar*		*N/A*	=	*not applicable*	
N/T	=	*nicht getestet*		*N/T*	=	*not tested*	

TEST SUMMARY

5.1.1 SUPPLY VOLTAGE REQUIREMENTS
RESULT: PASS

5.1.2 ANTENNA REQUIREMENTS
RESULT: PASS

5.1.3 RESTRICTED BANDS OF OPERATION
RESULT: PASS

5.2.1 RADIATED EMISSIONS OF TRANSMITTER (CARRIER, SPURIOUS AND HARMONICS)
RESULT: PASS

5.2.2 20DB BANDWIDTH
RESULT: PASS

5.2.3 99% BANDWIDTH

5.3.1 AC POWER LINE CONDUCTED EMISSION OF TRANSMITTER
RESULT: PASS

Contents

1. General Remarks

1.1 Complementary Materials

There is no attachment to this test report.

2. Test Sites

2.1 Test Facilities

TÜV Rheinland Japan Ltd. – Global Technology Assessment Center
4-25-2 Kita-Yamata, Tsuzuki-ku, Yokohama 224-0021, Japan

The used test equipment is in accordance with CISPR 16 for measurement of radio interference.

The Federal Communications Commission has reviewed the technical characteristics of the radiated and conducted emission facilities and has found these test sites to be in compliance with the requirements of section 2.948 of the FCC rules. The description of the test facility is listed under FCC registration number 299054.

The Industry Canada has reviewed the technical characteristics of the radiated and conducted emission facilities and has found these test sites to be in compliance with Canadian requirements. The description of the test facility is listed under OATS filing number 3466B-1.

The test facility is accredited by VLAC (member of ILAC) under number VLAC-017 according to ISO/IEC 17025:2005.

ilac-MRA VLAC Lab Accreditation VLAC-017

TÜV Rheinland Japan Ltd. is accredited by the Federal Communications Commission as a Conformity Assessment Body under Designation Number JP0017 and Test Firm Registration Number 386498.

2.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

Kind of Equipment	Manufacturer	Model Name	Serial Number	Equipment ID	Calibrated until
For AC Power Line Conducted Emission					
Conducted Emission Measurement Software	Toyo Corporation	EP5/CE	Ver. 5.0.20	RF-0025	2016-01
Receiver	Rohde & Schwarz	ESU 40	100029	RF-0021	2016-03
LISN	Rohde & Schwarz	ENV216	100276	RF-0016	2016-05
LISN	Rohde & Schwarz	ENV216	101958	RF-0708	2016-09
AC Extension Cable	Intertek	INTAP-EU-001	001	RF-0608	2016-05
For Radiated Emission					
Radiated Emission Measurement Soft-ware (below 30MHz)	Toyo Corporation	EP5/ME	Ver. 5.0.10	RF-0172	2016-01
Radiated Emission Measurement Soft-ware (above 30MHz)	Toyo Corporation	EP7/RE	Ver. 5.0.2	RF-0026	2016-01
Receiver	Rohde & Schwarz	ESU 8	100025	RF-0020	2016-08
Receiver	Rohde & Schwarz	ESU 40	100029	RF-0021	2016-03
RF Selector (10m Chamber)	Toyo Corporation	NS4900	0703-182	RF-0029	2016-01
Loop Antenna with Amplifier, 9kHz-30MHz	Rohde & Schwarz	HFH2-Z2	100139	RF-0048	2016-05
Trilog Antenna No. 2, 30-1000MHz	Schwarzbeck	VULB9168	9168-475	RF-0462	2015-12
10dB Attenuator	Hewlett Packard	8491A 10dB	58354	RF-0314	2016-01
Low Noise Preamplifier, 9kHz-1GHz	TSJ	MLA-10K01-B01-35	1370750	RF-0253	2016-01
Low Pass Filter, DC-1GHz	R&K	LP1000CH3	12104001	RF-0515	2016-01
Horn Antenna, 1-8GHz	Schwarzbeck	BBHA9120D	1059	RF-0553	2016-06
Microwave Preamplifier, 1-8GHz	Toyo Corporation	TPA0108-40	0634	RF-0052	2016-01
Horn Antenna with Preamplifier, 8-18GHz	Toyo Corporation	HAP06-18W	00000025	RF-0065	2016-07
High Pass Filter, 8-18GHz	Micro-Tronics	HPM50107	006	RF-0334	2016-07
Horn Antenna with Preamplifier, 18-26.5GHz	Toyo Corporation	HAP18-26N	00000010	RF-0070	2016-07
Horn Antenna with Preamplifier, 26.5-40GHz	Toyo Corporation	HAP26-40N	00000007	RF-0069	2016-07
Preamplifier, 26.5-40GHz	Toyo Corporation	HAP2640-S	-	RF-0258	2016-01

Kind of Equipment	Manufacturer	Model Name	Serial Number	Equipment ID	Calibrated until
For Transmitter and Receiver Radiated Spurious Emission (above 40GHz)					
Spectrum Analyzer	Agilent	E4447A	MY48250005	BT-8267	2015-12
Harmonic Mixer 40-60GHz	Agilent	11970U	MY30030222	BT-8348	2016-01
Horn Antenna 40-60GHz (RX)	Custom Microwave Inc.	HO19R	-	BT-8334	N/A
Harmonic Mixer 50-75GHz	Agilent	11970V	MY30033072	BT-8367	2016-01
Horn Antenna 50-75GHz (RX)	Custom Microwave Inc.	HO15R	-	BT-8336	N/A
Harmonic Mixer 75-110GHz	Agilent	11970W	MY25210462	BT-8350	2016-01
Horn Antenna 75-110GHz (RX)	Custom Microwave Inc.	HO10R	-	BT-8338	N/A
Constant Voltage Constant Frequency Stabilizers and Power Accessories					
CVCF (Shielded Room)	NF Corporation	ES2000S	9075612	RF-0210	N/A
CVCF Booster (Shielded Room)	NF Corporation	ES2000B	9074403	RF-0211	N/A
CVCF (10m Chamber)	NF Corporation	ES2000U	9067307	RF-0212	N/A
CVCF Booster (10m Chamber)	NF Corporation	ES2000B	9074408	RF-0213	N/A
True RMS Multimeter	Fluke	87V	16110176	RF-0414	2016-08

Conformance of the used measurement and test equipment with the requirements of ISO/IEC 17025:2005 has been confirmed before testing.

2.3 Measurement Uncertainty

Table 2: Emission Measurement Uncertainty

Measurement Type	Frequency	Uncertainty
AC Power Line Conducted Emission	150kHz - 30MHz	±2.0dB
Radiated Emission	9kHz – 150kHz	±4.0dB
	150kHz - 30MHz	±4.7dB
	30MHz - 1GHz	±4.7dB
	1GHz – 40GHz	±4.7dB
Radiated Emission (MMW)	40GHz - 50GHz	±4.6dB
	50GHz - 75GHz	±5.0dB
	75GHz – 110GHz	±5.0dB

3. General Product Information

3.1 Product Function and Intended Use

The EUT (**E**quipment **U**nder **T**est) is a movement sensor based on Doppler effect radar. The sensor module comprises transmitter and receiver. Transmitter and receiver can only be operated simultaneously. Since this receiver does not employ any local oscillator, the measurement output signal is derived directly from the difference of the emitted and received frequency (homodyne system).
The EUT has one signal processing circuit as Digital Interface portion and can output some monitoring status via wired interface port.

3.2 System Details

Specified output power:	Max. +17dBm
Antenna gain:	+7.1dBi
Antenna type:	Patch antenna (printed on PCB)
Antenna mounting type:	Internal
Frequency range:	24.075 to 24.175GHz
Nominal Frequency	24.125GHz
Number of channels:	1 (Fixed)
Modulation type:	No modulation (CW only)
FCC classification:	FDS
Emission designator:	51K5N0N for FCC
IC classification:	Field Disturbance Sensor
Emission designator:	59K3N0N for IC
Rated voltage:	DC 3.3 to 5.0V
Rated current:	60mA
Protection class:	III
Test voltage:	AC 120V for AC/DC Adapters DC 5.0V and 3.0V for EUT **(*)**
Test frequency:	60Hz for AC/DC Adapters

Note: **(*)** Two typical rating of commercial available AC/DC adapters were used.

3.3 Clock Frequencies

Nothing mentioned explicitly.

3.4 Noise Suppressing Parts

Refer to schematics.

4. Test Set-up and Operation Modes

4.1 Test Methodology

The test methodology used is based on the requirements of 47 CFR Part 15, Sections 15.31, 15.33, 15.35, 15.205, 15.207 and 15.209.

The test methods, which have been used, are based on ANSI C63.10-2013 and RSS-Gen (Issue 4).

For details, see under each test item.

4.2 Operation Modes

The basic operation mode used for testing is:

A. Intended operation continuous transmission and receiving at the channel (24.125GHz), a continuous wave with 100% duty cycle.

Note: The EUT does not have standby mode.

4.3 Physical Configuration for Testing

The EUT was tested on a stand-alone basis and the test system was configured in a typical fashion (as a customer would normally use it).

The justification and manipulation of cables and equipment in order to simulate a worst-case behavior of the test setup has been carried out as prescribed in ANSI C63.10-2013.

Figure 1: Block Diagram

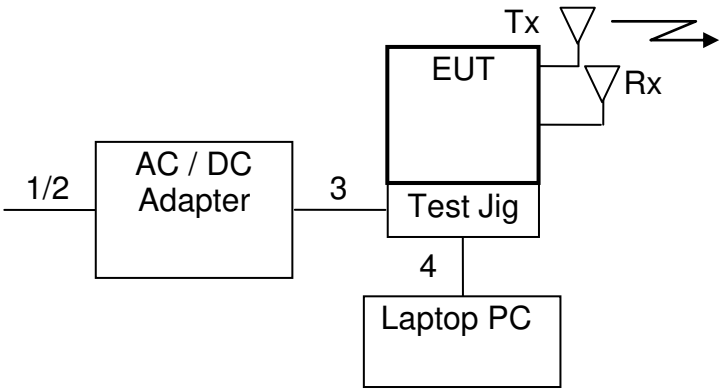


Table 3: Interfaces present on the EUT

No.	Interface	Cable Length for Testing, Shielding	Interface Classification
1.	AC Mains for AC / DC Adapter 1	(Direct plug-in type) **(**)**	AC Input Power Port
2.	AC Cable for AC / DC Adapter 2	1.8m, Un-shielded	AC Input Power Port
3.	DC Cable **(*)**	2.5m, Un-shielded	DC Input Power Port
4.	USB Cable **(*)**	2.6m, Shielded	Signal Line

Notes:

(*) Although all interface ports of the EUT are designed as **direct plug-in type** by manufacturer's specification, these ports were connected with cables as listed in above table for the testing purpose.

(**) AC extension cable (RF-0608) was used with the AC /DC adapter 1 (model NP12-US0320) at the section 5.3 AC Power Line Conducted Measurements.

EUT does not need any second radio device for the radio operating, since the EUT is a radar device and does not have any wireless data communication function.

Representative AC/DC adapters provided by the customer were tested together with the EUT. For details, refer to section 6: Photographs of the Test Set-Up.

4.4 Test Software

No special test software was used to operate the EUT.

4.5 Special Accessories and Auxiliary Equipment

The product has been tested together with the following additional accessories:

1. Product: AC Adapter 1 (For DC 3V)
   Manufacturer: GO FORWARD ENTERPRISE CORP.
   Model: NP12-US0320
   Rated Voltage: AC 100-240V
   Input Current: 0.3A
   Output Voltage: DC 3V
   Output Current: 2.0A
   Frequency: 50/60Hz
   Protection Class: II
   Serial Number: 1312-03

2. Product: AC Adapter 2 (For DC 5V)
   Manufacturer: UNIFIVE
   Model: UI318-05
   Rated Voltage: AC 100-240V
   Input Current: 0.4A
   Frequency: 50/60Hz
   Output Voltage: DC 5V
   Output Current: 3A
   Protection Class: II
   Serial Number: E01-0005228

3. Product: Laptop Computer
   Manufacturer: Dell
   Model: Latitude E6230
   Rated Voltage: DC 19.5V
   Input Current: 4.62A
   Protection Class: III
   Serial Number: 43272108829

4. Product: AC Adaptor for Laptop Computer
   Manufacturer: Dell
   Model: LA65NS2-01
   Rated Voltage: AC 100-240V
   Input Current: 1.6A
   Frequency: 50-60Hz
   Protection Class: II
   Serial Number: CN-06TM1C-72438-25A-3483-A00

5. Product: Test Jig
   Manufacturer: New Japan Radio
   Model: NJR4265 5000-t2.0
   Serial Number: Un-specified

Note:

Both AC/DC adapter(s) No. 1 and No. 2 were pre-checked for all test items.

For the radiated measurements, final measurements were conducted with the worst case AC/DC adapter No. 2.

For the AC conducted measurements, final measurements were conducted with the worst case AC/DC adapter No. 1.

The test jig provides a wired interface between the EUT and the laptop PC for testing purpose. EUT was connected directly to this test jig (without cable) through pins. Refer to a picture in section 6 for more details.

4.6 Countermeasures to achieve EMC Compliance

No additional measures were employed to achieve compliance.

5. Test Results RADIO

5.1 Technical Requirements

5.1.1 Supply Voltage Requirements

RESULT: **PASS**

Requirements:

FCC 15.31(e)

For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

Verdict:

The EUT has an internal voltage regulator to supply the RF circuit. Hence it complies with the supply voltage requirements.

5.1.2 Antenna Requirements

RESULT: **PASS**

Requirements:

FCC 15.203

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

Verdict:

The EUT has an internal antenna which is not user accessible. Hence it complies with the antenna requirements.

5.1.3 Restricted Bands of Operation

RESULT: **PASS**

Requirements:

FCC 15.205 and RSS-Gen 8.10

Only spurious emissions are permitted in any of the restricted frequency bands, unless otherwise specified.

Verdict:

The EUT operation frequency range is 24.075 - 24.175GHz. It was verified during testing that the carrier is fully contained within the unrestricted frequency band 24.075 - 24.175GHz. Therefore only spurious emissions except for second and third harmonics of carrier may be found in the restricted bands of operation and the EUT complies with the restricted frequency band requirement. For details, refer to section 5.2.1 Radiated Emissions of Transmitter (Carrier, Spurious and Harmonics) at this test report.

5.2 Radiated Measurements

5.2.1 Radiated Emissions of Transmitter (Carrier, Spurious and Harmonics)

RESULT: **PASS**

Date of testing:	2015-10-27, 2015-10-30, 2015-11-04 2015-11-05
Ambient temperature:	24, 22, 23, 22°C
Relative humidity:	40, 50, 40, 44%
Atmospheric pressure:	1011, 1012, 1029, 1022hPa
Frequency range:	9kHz - 100GHz
Measurement distance:	3m in the range 9kHz – 40GHz 0.1m in the range 40GHz – 50GHz 0.01m in the range 50GHz – 100GHz
Kind of test site:	Semi Anechoic Chamber

Requirements:

FCC 15.209, 15.245 and 15.205. RSS-Gen 8.9, 8.10 and RSS-210 Annex 7.

Radiated emissions must comply with the limits specified in FCC 15.209(a), 15.245(b) (1) (ii) and 15.205, RSS-Gen 8.9 Table 4 and Table 5, 8.10 Table 6 and RSS-210 Annex 7.

Test procedure:

ANSI C63.10-2013

The EUT was placed on a nonconductive turntable 1.5m above the ground plane. Before final measurements of radiated emissions were performed, the EUT was scanned to determine its emission spectrum profile. The physical arrangement of the test system, the associated cabling and the EUT orientation (X, Y and Z) were varied in order to ensure that maximum emission amplitudes were attained.

The spectrum was examined from 9kHz to the 5th harmonic of highest fundamental frequency or to 100 GHz, whichever is lower (i.e. 100GHz) according to the ANSI C63.10-2013 Table 2 of clause 5.5. Final radiated emission measurements were made at 3m, 0.1m or 0.01m distance.

At each frequency where a spurious emission was found, the EUT was rotated 360° and the antenna was raised and lowered from 1 to 4m in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations.

For emissions between 30MHz and 1GHz, measurements were performed with a test receiver operating in the CISPR quasi-peak detection mode. The receiver's 6dB bandwidth was set to 120kHz. For emissions above 1GHz, measurements were performed with a spectrum analyzer using the following settings: for peak field strength: RBW = 1MHz & VBW ≥ 1MHz; for average field strength: RBW = 1MHz & VBW = 10Hz.

Absorbers have been placed on the floor between the EUT and the measuring antenna for testing above 1GHz.

The highest emission amplitudes relative to the appropriate limit were recorded in this report. Emissions other than those mentioned are small or not detectable.

No spurious emissions were found in the range from 9kHz to 30MHz.

The spectra for the range from 40GHz to 50GHz taken at a distance of 0.1m did not show any spurious emission other than second harmonics. The spectra for the range from 50GHz to 100GHz taken at a distance of 0.01m did not show any spurious emission other than third harmonics.

Table 4: Radiated Emissions of the Carrier, Average Data, Mode A (24.125GHz)

Frequency [MHz]	EUT / Antenna Orientation	Reading AV at 3m [dBµV]	Factor [dB(1/m)]	Level AV at 3m [dBµV/m]	Limit at 3m [dBµV/m]	Margin AV [dB]	Height [cm]	Angle [°]
24135.850	Z / V	108.6	-4.4	104.2	128	23.8	170	342

Note: Level AV = Reading AV + Factor

Table 5: Radiated Emissions of the Carrier, Peak Data, Mode A (24.125GHz)

Frequency [MHz]	EUT / Antenna Orientation	Reading PK at 3m [dBµV]	Factor [dB(1/m)]	Level PK at 3m [dBµV/m]	Limit at 3m [dBµV/m]	Margin PK [dB]	Height [cm]	Angle [°]
24135.850	Z / V	108.7	-4.4	104.3	148	43.7	170	342

Note: Level PK = Reading PK + Factor

Table 6: Radiated Emissions of the Harmonics of Carrier, Average Data, Mode A (24.125GHz)

Frequency [MHz]	EUT / Antenna Orientation	Reading AV [dBµV/m]	Distance Conversion Factor [dB]	Level AV at 3m [dBµV/m]	Limit at 3m [dBµV/m]	Margin AV [dB]	Height [cm]	Angle [°]
48275.500	Z / V	85.3 **(*)** at 0.1m	-29.5	55.8	77.5	21.7	-/-	0
72409.400	Z / V	100.5 **(*)** at 0.01m	-49.5	51.0	77.5	26.5	-/-	0

Note: (*) Peak measurement data was used against Average limit instead of average measurement data.

Level AV at 3m = Reading AV + Distance conversion factor

Each distance conversion factor was considered for second and third harmonics measurement by the following formula.

Distance conversion factor = 20 × Log_{10} (d / 3), where d = measurement distance in m;

– Distance conversion factor = 20 × Log_{10} (0.1 / 3) = -29.5 [dB] for second harmonic,

– Distance conversion factor = 20 × Log10 (0.01 / 3) = -49.5 [dB] for third harmonic.

Table 7: Radiated Emissions of the Harmonics of Carrier, Peak Data, Mode A (24.125GHz)

Frequency [MHz]	EUT / Antenna Orientation	Reading PK [dBµV/m]	Distance Conversion Factor [dB]	Level PK at 3m [dBµV/m]	Limit at 3m [dBµV/m]	Margin PK [dB]	Height [cm]	Angle [°]
48275.500	Z / V	85.3 (at 0.1m)	-29.5	55.8	97.5	41.7	-/-	0
72409.400	Z / V	100.5 (at 0.01m)	-49.5	51.0	97.5	46.5	-/-	0

Note: Level PK at 3m = Reading PK + Distance conversion factor

Each distance conversion factor was considered for second and third harmonics measurement by the following formula.

Distance conversion factor = 20 × Log_{10} (d / 3), where d = measurement distance in m;

– Distance conversion factor = 20 × Log_{10} (0.1 / 3) = -29.5 [dB] for second harmonic,

– Distance conversion factor = 20 × Log10 (0.01 / 3) = -49.5 [dB] for third harmonic.

Table 8: Radiated Spurious Emissions at Band Edge, Mode A (24.125GHz)

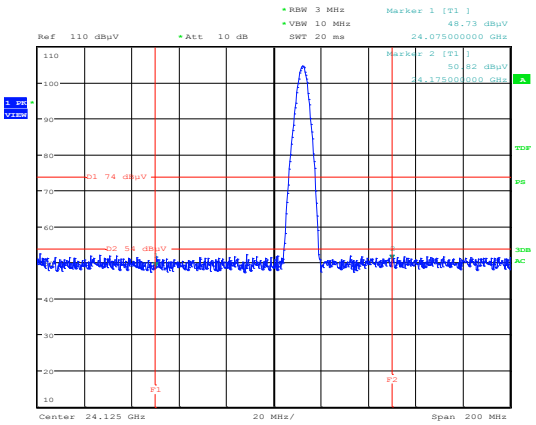
Spurious Emission Frequency [GHz]	EUT / Antenna Orientation	Level AV [dBµV/m]	Level PK [dBµV/m]	Limit AV [dBµV/m]	Limit PK [dBµV/m]	Margin AV [dB]	Margin PK [dB]
24.075	Z / V	N/T (*)	48.73	54.00	74.00	N/T (*)	25.27

Notes: All correction factors (antenna, cable, pre-amplifier) are included in the measurement values.
Average limit in dBµV/m is calculated as follows: Average limit = 20 × Log_{10} (500µV/m).
Peak limit in dBµV/m is calculated as follows: Peak limit = Average limit + 20dB.

(*) Peak emissions level has met against the average limit 54dBµV/m. Therefore, average measurement was omitted.

RBW was used at 3MHz instead of 1MHz. Test result at 3MHz RBW was more severe than those of at 1MHz RBW.

Figure 2: Radiated Emissions at Band Edge, Spectral Diagram, Mode A (24.125GHz)



Band Edge, Z, V, 5V
Date: 4.NOV.2015 19:11:03

Table 9: Radiated Spurious Emissions, Quasi Peak Data, 30MHz - 1GHz, Horizontal and Vertical Antenna Orientations, Mode A (24.125GHz)

Frequency [MHz]	EUT / Antenna Orientation	Reading QP [dBµV]	Factor [dB(1/m)]	Level QP [dBµV/m]	Limit [dBµV/m]	Margin QP [dB]	Height [cm]	Angle [°]
30.108	Z / V	41.5	-17.5	24.0	40.0	16.0	102	224
43.474	Z / V	40.6	-16.1	24.5	40.0	15.5	101	153
63.063	Z / V	47.3	-16.9	30.4	40.0	9.6	102	359
65.335	Z / V	44.4	-17.0	27.4	40.0	12.6	100	353
85.324	Z / H	35.5	-19.7	15.8	40.0	24.2	382	256
119.757	Z / V	44.0	-17.2	26.8	43.5	16.7	100	179
160.271	Z / H	31.6	-14.5	17.1	43.5	26.4	384	82
216.001	Z / V	44.1	-16.2	27.9	46.0	18.1	100	93
319.994	Z / V	40.4	-12.5	27.9	46.0	18.1	234	259
361.934	Z / H	33.0	-11.6	21.4	46.0	24.6	269	48
474.597	Z / V	35.3	-8.4	26.9	46.0	19.1	117	271
687.515	Z / V	35.7	-4.9	30.8	46.0	15.2	152	335
836.507	Z / H	32.4	-3.4	29.0	46.0	17.0	149	34

Note: Level QP = Reading QP + Factor

Table 10: Radiated Spurious Emissions, Average Data, 1 - 40GHz, Horizontal and Vertical Antenna Orientations, Mode A (24.125GHz)

Frequency [MHz]	EUT / Antenna Orientation	Reading AV [dBµV]	Factor [dB(1/m)]	Level AV [dBµV/m]	Limit [dBµV/m]	Margin AV [dB]	Height [cm]	Angle [°]
20632.160	Z / V	37.8	-2.8	35.0	54.0	19.0	151	289

Note: Level AV = Reading AV + Factor

Table 11: Radiated Spurious Emissions, Peak Data, 1 - 40GHz, Horizontal and Vertical Antenna Orientations, Mode A (24.125GHz)

Frequency [MHz]	EUT / Antenna Orientation	Reading PK [dBµV]	Factor [dB(1/m)]	Level PK [dBµV/m]	Limit [dBµV/m]	Margin PK [dB]	Height [cm]	Angle [°]
20632.160	Z / V	52.0	-2.8	49.2	74.0	24.8	151	289

Note: Level PK = Reading PK + Factor

5.2.2 20dB Bandwidth

RESULT: **PASS**

Date of testing: 2015-11-04

Ambient temperature: 22°C
Relative humidity: 40%
Atmospheric pressure: 1029hPa

Requirements:

FCC 15.215(c)

Intentional radiators must be designed to ensure that the 20 dB bandwidth of the emission is contained within the frequency band.
Since frequency stability is not specified in the regulations section 15.245, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

Test procedure:

ANSI C63.10-2013

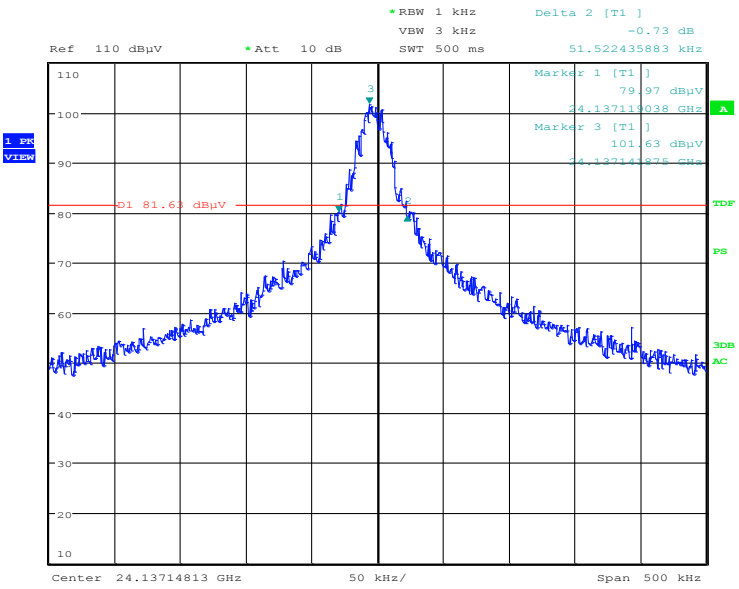
The 20dB bandwidth was measured with a spectrum analyzer using a peak detector. The resolution bandwidth was set to 1kHz. And the video bandwidth was set to 3kHz.

Table 12: 20dB Bandwidth

EUT / Antenna Orientation	Nominal Operating Frequency [GHz]	Actual Center Frequency [GHz]	20dB Bandwidth [kHz]
Z / V	24.125	24.13714	51.522

Note: Since 80% of the permitted band (i.e. 24.075 to 24.175GHz) is from 24.085 to 24.165GHz, each actual center frequency as listed here above is within this 80% of the band.

Figure 3: Radiated Emissions at 20dB Bandwidth, Spectral Diagram, Mode A (24.125GHz)



20dB Bandwidth, Z, V, 5V
Date: 4.NOV.2015 19:22:23

Note: This 20 dB bandwidth of the emission is contained within the frequency band.

5.2.3 99% Bandwidth

Date of testing:	2015-11-04
Ambient temperature:	22°C
Relative humidity:	40%
Atmospheric pressure:	1029hPa

Requirements:

RSS-Gen 6.6

The 99% bandwidth shall be reported according to RSS-Gen 6.6.

Test procedure:

RSS-Gen 6.6

The EUT was placed on a nonconductive turntable 1.5m above the ground plane. Measurements were made at 3m distance. The EUT was rotated 360° and the antenna was raised and lowered from 1 to 4m in order to determine the emission's maximum level.

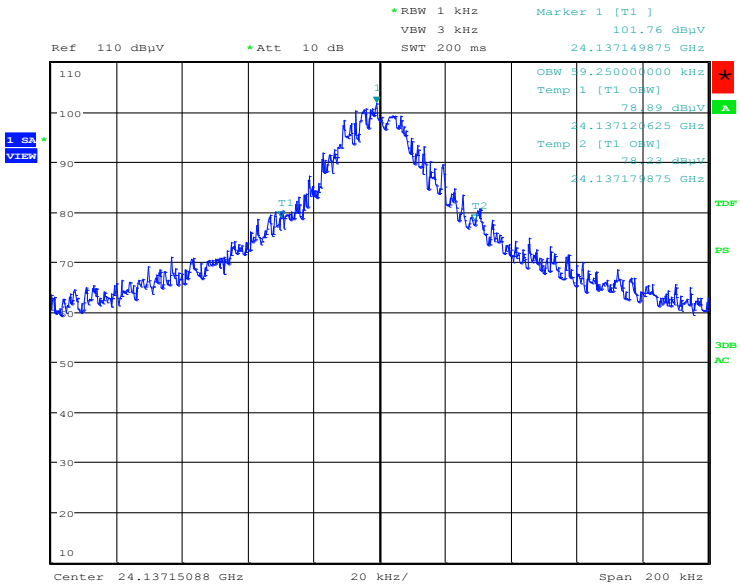
Measurements were taken using both horizontal and vertical antenna polarizations for 3 EUT orientations (X, Y and Z). The results corresponding to the worst case antenna polarization and EUT orientation are recorded in this report.

Final measurements were performed using a spectrum analyzer with the resolution bandwidth (RBW) set to in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3 × RBW. The 99% bandwidth was measured by using the OBW function of the analyzer with a 99% coverage setting. Sample detector was used for this test item.

Table 13: 99% Bandwidth

EUT / Antenna Orientation	Nominal Operating Frequency [GHz]	Actual Center Frequency [GHz]	99% Bandwidth [kHz]
Z / V	24.125	24.13715	59.250

Figure 4: 99% Bandwidth, Mode A (24.125GHz)



99per Bandwidth, Z, V, 5V
Date: 4.NOV.2015 19:27:13

Note: This RBW was set to 1.68% of the OBW. (1 kHz / 59.250 kHz) × 100 = 1.68 %

5.3 AC Power Line Conducted Measurements

5.3.1 AC Power Line Conducted Emission of Transmitter

RESULT: **PASS**

Date of testing:	2015-11-02, 2015-11-04
Ambient temperature:	25, 22°C
Relative humidity:	40, 40%
Atmospheric pressure:	1012, 1029hPa
Frequency range:	0.15 - 30MHz
Kind of test site:	Shielded Room

Requirements:

FCC 15.207 and RSS-Gen 8.8

The AC power line conducted emission on any frequency within the band 150kHz to 30MHz shall not exceed the limits specified in FCC 15.207 and RSS-Gen 8.8 Table 3.

Test procedure:

ANSI C63.10-2013

The EUT was placed on a wooden table raised 80cm above the reference ground plane. A vertical conducting plane of the screened room was located 40cm to the rear of the EUT. The AC adapter of the EUT was connected to a Line Impedance Stabilization Network (LISN).

The physical arrangement of the test system and associated cabling was varied to determine the effect on the EUT's emissions in amplitude and frequency in order to ensure that maximum emission amplitudes were attained.

The measurements were performed with a test receiver operating in the CISPR quasi-peak and average detection modes. The receiver's 6dB bandwidth was set to 9kHz.

Disturbances other than those mentioned are small or not detectable.

Table 14: AC Power Line Conducted Emission, Quasi Peak and Average Data, 0.15 - 30MHz, Phase (N) and (L1), Mode A (24.125GHz)

Freq. [MHz]	Phase	Reading QP [dBµV]	Reading AV [dBµV]	Factor [dB]	Level QP [dBµV]	Level AV [dBµV]	Limit QP [dBµV]	Limit AV [dBµV]	Margin QP [dB]	Margin AV [dB]
0.18815	N	22.4	5.0	9.6	32.0	14.6	64.1	54.1	32.1	39.5
0.26229	L1	36.5	22.7	9.6	46.1	32.3	61.4	51.4	15.3	19.1
0.40938	N	32.4	19.2	9.6	42.0	28.8	57.7	47.7	15.7	18.9
0.51752	N	27.7	11.0	9.6	37.3	20.6	56.0	46.0	18.7	25.4
0.77562	N	26.5	11.7	9.6	36.1	21.3	56.0	46.0	19.9	24.7
1.03713	L1	25.6	6.2	9.7	35.3	15.9	56.0	46.0	20.7	30.1
1.29199	L1	23.9	5.4	9.7	33.6	15.1	56.0	46.0	22.4	30.9
1.55071	N	22.6	9.6	9.7	32.3	19.3	56.0	46.0	23.7	26.7
14.03220	L1	19.3	9.9	10.0	29.3	19.9	60.0	50.0	30.7	30.1

Note: Level QP = Reading QP + Factor, Level AV = Reading AV + Factor

7. List of Tables

8. List of Figures

9. List of Photographs